

Atty. Docket No.: CA1467
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.114(c)
U.S. Application No.: 10/033,584

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

LISTING OF CLAIMS:

1. *(Currently Amended)* A method of backup and restore procedure using a first storage subsystem and second storage subsystem which are connected to each other via a path, the first storage subsystem connected to a first host, the second storage subsystem connected to a second host, the method comprising the steps of:

performing a backup procedure comprising the steps of:

providing a first logical volume in the first storage subsystem and a second logical volume and a third logical volume in the second storage subsystem, the second logical volume being a copied logical volume of the first logical volume, the first and second logical volumes being in sync state, the third logical volume being a copied logical volume of the second logical volume, the second and third logical volumes being in sync state; and

splitting the second logical volume and the third logical volume by a command sent by ~~from~~ the first storage subsystem; and

performing a restore procedure comprising the steps of:

mounting the third logical volume to the second host,

receiving an indication of an individual file to be restored.

Atty. Docket No.: CA1467
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.114(c)
U.S. Application No.: 10/033,584

reading, at the second host, [[a]] the file to be restored from the third volume,
writing, at the second host, the file to the second volume, and
re-synchronizing the first volume with the second volume.

2. *(Original)* The method of claim 1, wherein
performing a restore procedure further comprises:
recovering a database onto the first volume, if a database application is being run on the
first host.

3. *(Original)* The method of claim 1, wherein
re-synchronizing the first volume with the second volume
further comprises:
determining from a pending data bitmap data on the second volume to be copied to the
primary volume.

4. *(Original)* The method of claim 1, further comprising
marking write data arriving after the command in a pending data bitmap,
thereby tracking which data has been modified.

5. *(Original)* The method of claim 1, wherein
the command comprises identities of one or more files to be restored from the third
volume and written to the second volume, and wherein

reading, at the second host, a file to be restored from the third volume and

Atty. Docket No.: CA1467
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.114(c)
U.S. Application No.: 10/033,584

writing, at the second host, the file to the second volume,
further comprises:
reading exclusively the files specified in the command from the third volume and writing
the files so read to the second volume.

6. (*Currently Amended*) A method, comprising:
receiving an indication of individual files to be restored;
determining whether the files to be restored comprise contents of an entire volume, and if
so:

splitting remote mirrors existing between production volumes and backup volumes by a
command sent by a primary storage subsystem associated with the production volumes;
resynchronizing local mirrors existing between the backup volumes and volumes holding
data copied from the backup volumes, at least one of the backup volumes and at least one of the
volumes holding data copied from the at least one backup volume being located in the same
storage subsystem; and
resynchronizing remote mirrors for the production volumes and the backup volumes.

7. (*Original*) The method of claim 6, wherein
resynchronizing local mirrors existing between the backup volumes and volumes holding
data copied from the backup volumes comprises:
comparing a pending bitmap for the backup volume with a pending bitmap for the
volume holding data copied from the backup volume to determine a set of differential data; and

Atty. Docket No.: CA1467
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.114(c)
U.S. Application No.: 10/033,584

copying the differential data from the volume holding data copied from the backup volume to the backup volume.

8. *(Original)* The method of claim 6, wherein
resynchronizing remote mirrors for the production volumes and the backup volumes
comprises:

comparing a pending bitmap for the production volume with a pending bitmap for the
backup volume to determine a set of differential data; and

copying the differential data from the backup volume to the production volume.

9. *(Currently Amended)* A processor-based apparatus, comprising:
means for receiving an indication of individual files to be restored by means of a
command sent by a storage subsystem associated with production volumes;
means for determining whether the files to restore comprise contents of an entire volume;
means for splitting remote mirrors existing between the production volumes and backup
volumes;

means for resynchronizing local mirrors existing between the backup volumes and
volumes holding data copied from the backup volumes, at least one of the backup volumes and at
least one of the volumes holding data copied from the at least one backup volume being located
in the same storage subsystem; and

means for resynchronizing remote mirrors for the production volumes and the backup
volumes.

Atty. Docket No.: CA1467
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.114(c)
U.S. Application No.: 10/033,584

10. (*Currently Amended*) A method of restoring a file to a first storage subsystem connected to a first host from a second storage subsystem connected to a second host, in accordance with a request from the first host, wherein:

the first storage subsystem and second storage subsystem are connected to each other via a path, the first storage subsystem stores a first logical volume, the second storage subsystem stores a second logical volume and a third logical volume, the second logical volume being a copied logical volume of the first logical volume, the third logical volume being a copied logical volume of the second logical volume, the first logical volume and the second logical volume being in a non-sync state, the second and third logical volumes being in sync state,

the method comprising:

mounting the third logical volume to the second host by a command sent by the first storage subsystem,

receiving indication of an individual file to be restored,

reading, at the second host, [[a]] the file to be restored from the third volume and

writing, at the second host, the file to the second volume, and

re-synchronizing the first volume with the second volume.

11. (*Currently Amended*) The method of claim 10, wherein:
mounting the third logical volume to the second host comprises:
responsive to [[a]] the command from the first storage subsystem, splitting the sync state between the second logical volume and the third logical volume.

Atty. Docket No.: CA1467
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.114(c)
U.S. Application No.: 10/033,584

12. *(Currently Amended)* A processor-based storage subsystem, comprising:
- a first logical volume,
 - a second logical volume, the first logical volume and the second logical volume being located in the same storage subsystem, and
 - an interface to a path providing connectivity to a primary storage subsystem,
 - the second logical volume being a copied logical volume of the first logical volume,
 - the first logical volume operative to be selectively placed into one of a sync state and a non-sync state with a logical volume in the primary storage subsystem,
 - the first logical volume and second logical volume being in sync state, wherein the first logical volume and the second logical volume are operable to break the sync state in response to a command ~~[[from]]~~ sent by the primary storage subsystem,
 - the second logical volume operative to receive indication of individual files to be restored, permit host access to read the files to be restored from the second logical volume and write the files to be restored to the first logical volume responsive to a restore command, and
 - the second storage subsystem operative to establish a sync state between the first logical volume and the second logical volume.
13. *(Currently Amended)* A computer program product, comprising:

Atty. Docket No.: CA1467
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.114(c)
U.S. Application No.: 10/033,584

code for receiving an indication of individual files to be restored by means of a command sent by a storage subsystem associated with production volumes;

code for determining whether the files to be restored comprise contents of an entire volume, and if so invoking a plurality of codes, comprising:

code for splitting remote mirrors existing between production volumes and backup volumes;

code for resynchronizing local mirrors existing between the backup volumes and volumes holding data copied from the backup volumes, at least one of the backup volumes and at least one of the volumes holding data copied from the at least one backup volume being located in the same storage subsystem;

code for resynchronizing remote mirrors for the production volumes and the backup volumes; and

a computer readable storage medium that holds the codes.

14-15. (*Canceled*)

16. (*Currently Amended*) A processor-based apparatus, comprising:

means for receiving a command;

means for splitting a sync state existing between a second storage means and a third storage means in response to a command ~~received from~~ sent by a first storage means, the second storage means and the third storage means being located in the same storage subsystem;

means for making information on the third storage means available for reading;

Atty. Docket No.: CA1467
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.114(c)
U.S. Application No.: 10/033,584

means for receiving an indication of an individual file to be restored;

means for reading [[a]] the file to be restored from the third storage means;

means for writing the file to the second storage means; and

means for re-synchronizing the second storage means with the first storage means.

17. *(Original)* The apparatus of claim 16, wherein

means for making information on the third storage means available for reading further comprises means for mounting the third storage means to a means for processing information stored by the third storage means.

18. *(Currently Amended)* A computer program product, comprising:

code for receiving a command;

code for splitting a sync state existing between a second storage unit and a third storage unit in response to [[a]] the command ~~received from~~ sent by a first storage subsystem;

code for making information on the third storage unit available for reading;

code for receiving indication of an individual file to be restored;

code for reading [[a]] the file to be restored from the third storage unit;

code for writing the file to the second storage unit;

code for re-synchronizing the second storage unit with a first storage unit; and

a computer-readable storage medium that holds the codes, wherein the first storage subsystem comprises the first storage unit.

Atty. Docket No.: CA1467
PATENT APPLICATION

AMENDMENT UNDER 37 C.F.R. § 1.114(c)
U.S. Application No.: 10/033,584

19. *(Currently Amended)* A system, comprising:

a first storage subsystem connected to a first host,

a second storage subsystem connected to a second host, wherein:

the first storage subsystem and the second storage subsystem are connected to each other via a path, the first storage subsystem stores a first logical volume, the second storage subsystem stores a second logical volume and a third logical volume, the second logical volume being a copied logical volume of the first logical volume, the third logical volume being a copied logical volume of the second logical volume, the first logical volume and the second logical volume being in a non-sync state, the second and third logical volumes being in sync state, the second and third logical volumes being operable to break the sync state in response to a command sent by [[from]] the first storage subsystem,

the second storage subsystem operative to receive an indication of an individual file to be restored, mount the third logical volume to the second host responsive to a restore command, the host operative to read the file[[s]] to be restored from the third volume and write the files to be restored to the second volume, and the second storage subsystem operative to establish a sync state between the first logical volume and the second logical volume.

20. *(Canceled)*